WE CLAIM:

1. A nanotube having a controllably shaped contour and a varying cross-sectional dimension along the longitudinal axis.

2. The nanotube of claim 1, wherein the nanotube is comprised of a material having a layered structure.

3. The nanotube of claim 2,wherein the material is selected from the group consisting of carbon, boron nitride, boron carbide, carbon nitride, boron carbon nitride and transition metal chalcogenides.

4. The nanotube of claim 3, wherein the material is carbon.

5. The nanotube of claim 2, wherein at least a portion of the nanatube comprises 1 to about 1000 layers.

6. The nanotube of claim 5, wherein at least a portion of the nanotube comprises 1 to about 100 layers.

7. The nanotube of claim 6, wherein at least a portion of the nanotube comprises about 2 to about 50 layers.

8. The nanotube of claim 1, wherein the controllably shaped contour is tapered.

9. The nanotube of claim 1, wherein cross-sectional dimension of the nanotube along the longitudinal axis varies by up to about 100-fold.

10. The nanotube of claim 9, wherein the cross-sectional dimension of the nanotube along longitudinal axis varies by about 2-fold to about 10-fold.

11. The nanotube of claim 1, wherein the nanotube is substantially symmetric about the longitudinal axis.

12. The nanotube of claim 1, wherein the nanotube is substantially asymmetric about the longitudinal axis.

13. The nanotube of claim 1, wherein the nanotube exhibits substantially no exfoliation.

14. A catalyst comprising the nanotube of claim 1.

15. An electrode comprising the nanotube of claim 1.

16. The electrode of claim 15, wherein the electrode is a biological cell electrode.

17. An electronic system comprising the nanotube of claim 1.

18. A mechanical system comprising the nanotube of claim 1.

19. An emission tip comprising the nanotube of claim 1.

20. The emission tip of claim 19, wherein the emission tip is an electron field emission tip.

21. The emission tip of claim 19, wherein the emission tip is a scanned probe microscope emission tip.

22. A probe for biological insertion comprising the nanotube of claim 1.

23. A three-dimensional object comprising a material having a layered structure and having a controllably shaped exterior contour, wherein at least one dimension of the solid article does not exceed about 100 nm in length.

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